Dec 11th, 1:30 PM - 3:10 PM

Reducing slope improves small fish passage through a Denil fishway

Lee Baumgartner
Charles Sturt University

Martin Mallen-Cooper
Charles Sturt University

Ivor Stuart
Arthur Rylah Institute

Brenton Zampatti
SARDI Aquatic Sciences

Improving passage through Denil fishways in the Murray-Darling Basin

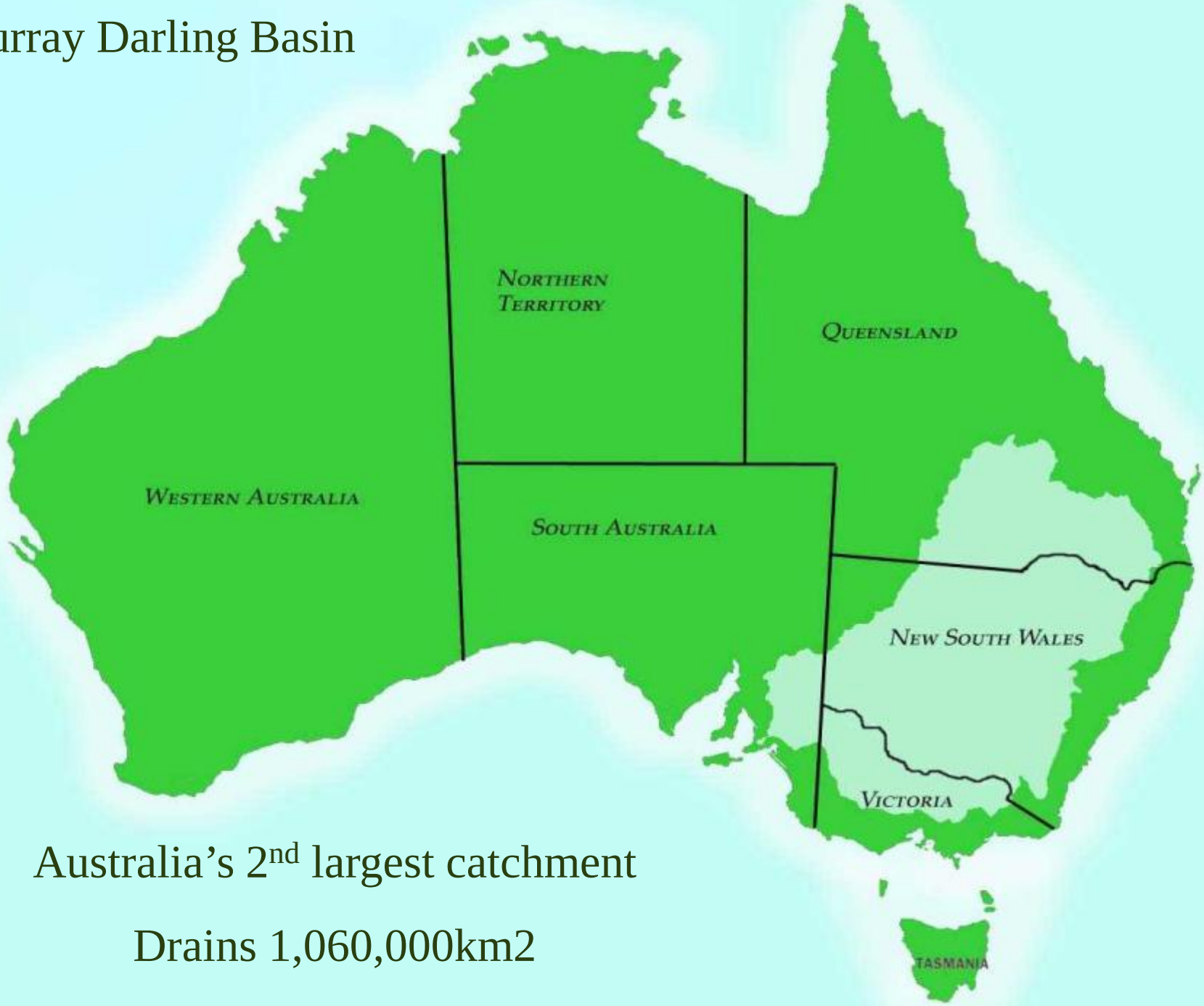
Lee Baumgartner
Charles Sturt University; Institute for Land Water and Society

Martin Mallen-Cooper,
Fishway Consulting Services; Charles Sturt University

Ivor Stuart
Kingfisher Research; Arthur Rylah Institute

Brenton Zampatti
SARDI Aquatic Sciences

Murray Darling Basin



Australia's 2nd largest catchment

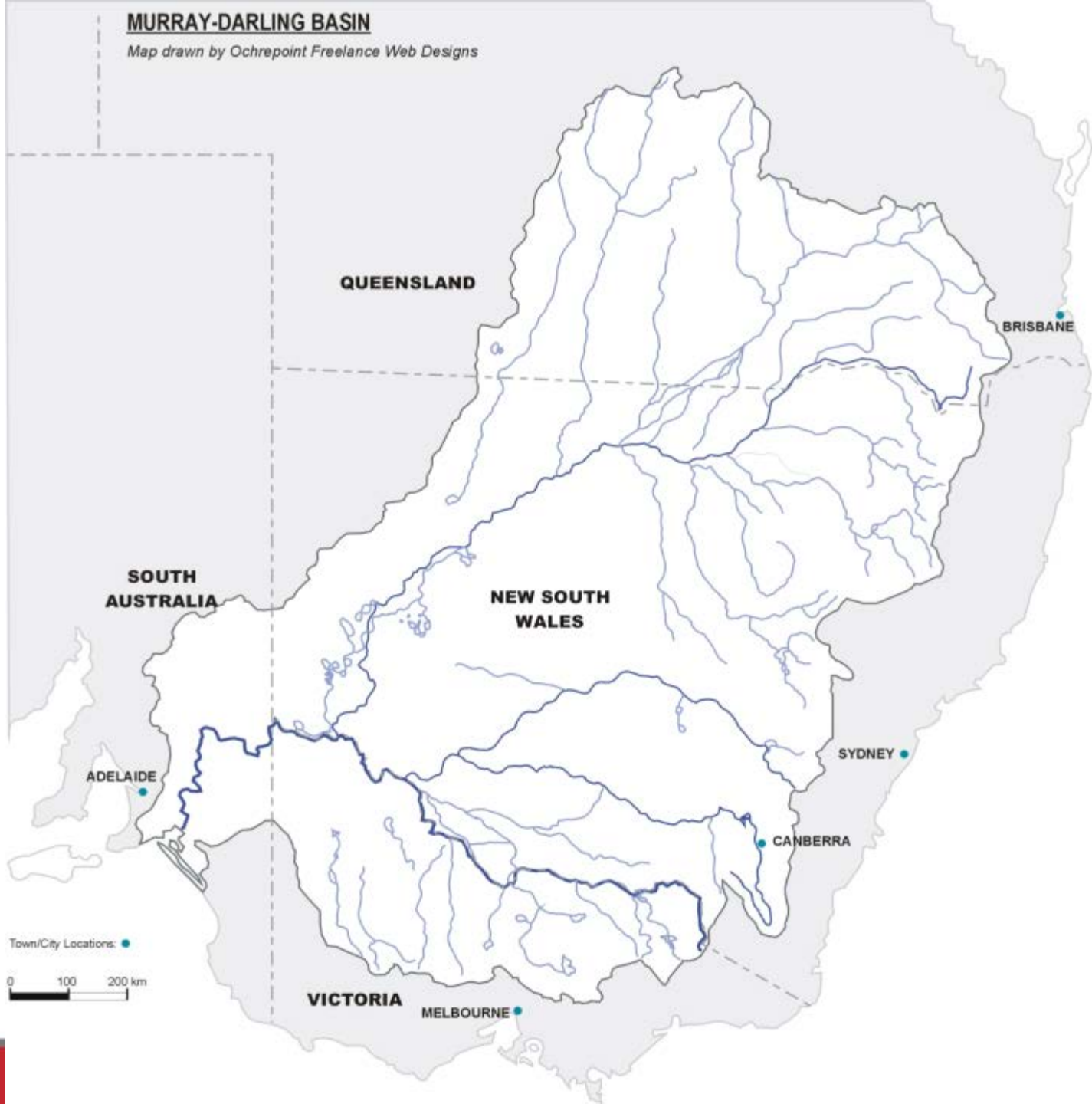
Drains 1,060,000km2

A little over 2 Million people

40% Australian agricultural production

95% of rainfall in 2% of catchment

56 species of fish



Golden perch

Murray cod

Silver perch

Many other smaller species

Migrate only freshwater

Charles Sturt University

Three modes of upstream movement in MDB

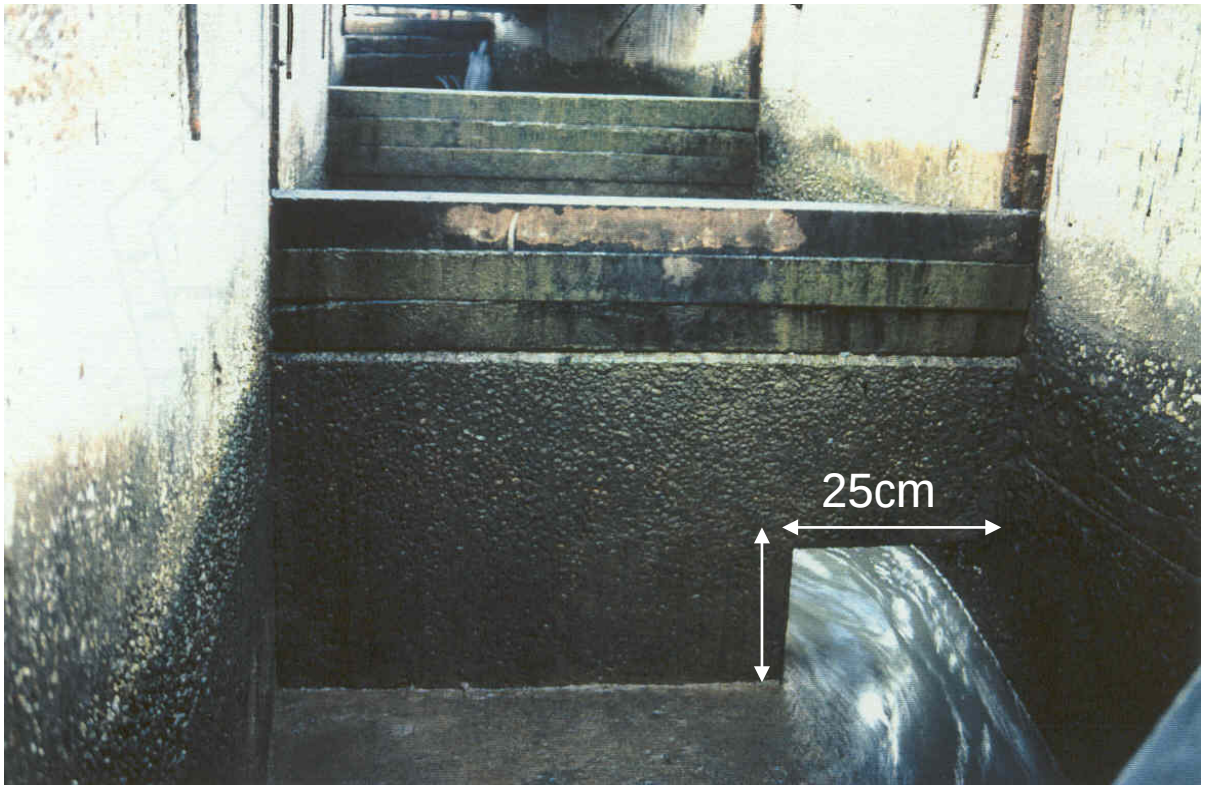
Large Fish

Immature / juv

Small fish

Early Fishways – Pre 1980's

Submerged Orifice Fishways



Very steep

High turbulence

High velocity


Not too bad for big fish, but what about small fish?

Construct many

Tibooburra
Tweed Heads
Moree
Grafton
Bourke
Wolgett
Gwydir River
Namoi River
Darling River
Tamworth
Kempsey
Wilcannia
Nyngan
Macquarie River
Broken Hill
Dubbo
Newcastle
Parkes
Bathurst
Lachlan River
Wentworth
Murrumbidgee River
Narrandera
Goulburn
Wagga Wagga
CANBERRA
Deniliquin
Batemans Bay
Murray River
Albury
Bega

Legend

Ineffective fishways

Towns

N

0 65 130 260 Kilometers

So what do we do with all these old fishways?

Can they be retrofitted to improve passage?

Denil fishways

Euston Weir (Lock 15), Murray River

Retrofitted with Denil and Fish Lock in 2013

Assessment to determine effectiveness

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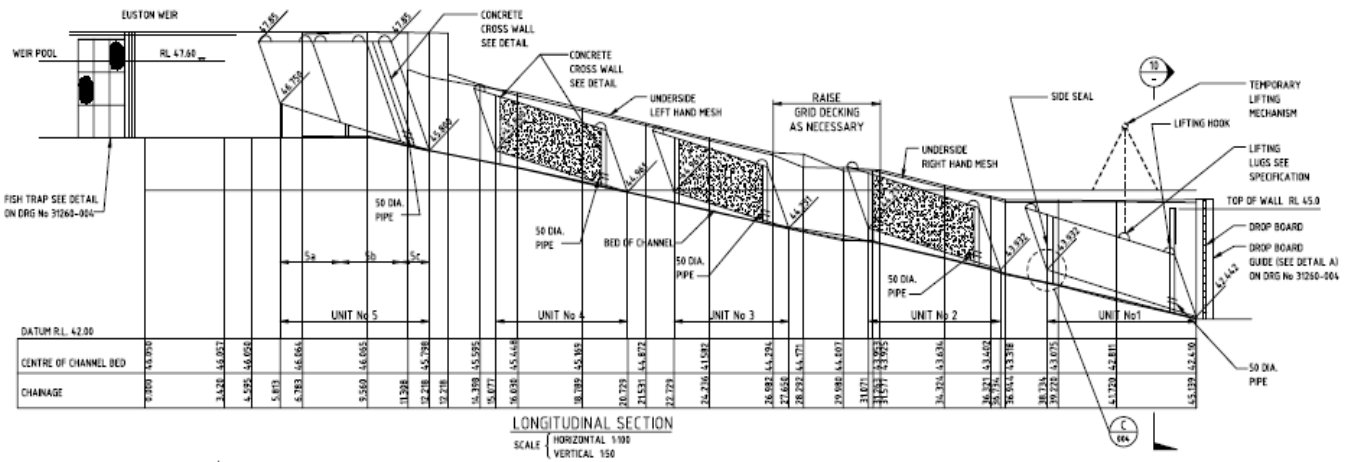
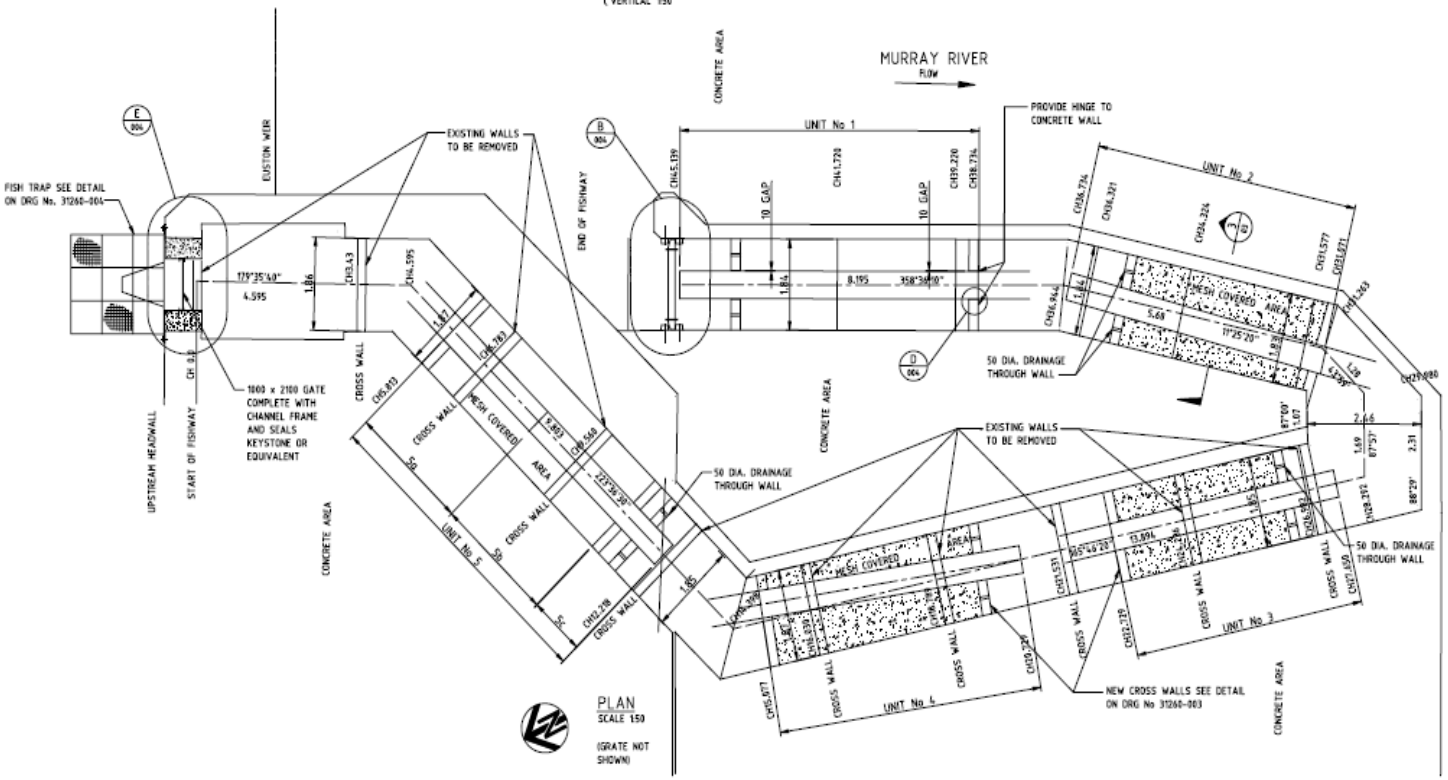


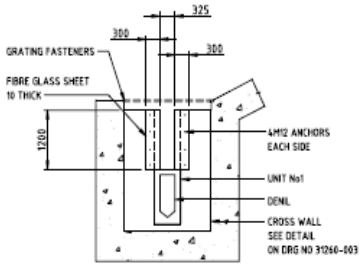
LONGITUDINAL SECTION
SCALE { HORIZONTAL 1:100 / VERTICAL 1:50

MATERIAL LIST

ITEM	DESCRIPTION	SPECIFICATION	REQ'D	QTY	UNIT
1	12mm CHEMICAL ANCHORS	RAMSET OR EQUIVALENT	150		NO
2	GRATING FASTENERS	SEE SPECIFICATIONS	AS REQUIRED		NO
3	FISHTRAP	STEEL GALVANISED	1	-	NO.
4	M20 DIA. X 200mm LONG CHEMICAL ANCHORS	GALVANISED STEEL	12	-	NO.
5	1000 WIDE BY 2100 HIGH GATE COMPLETE WITH WALL MOUNTED FRAME & SEALS	GATE AND FRAME, PENSTOCK MODEL F980 KEYSTONE OR EQUIV	1		NO.
6	DROPBOARD LIFTER	STEEL GALVANISED	2	-	NO
7	DROPBOARD GUIDES	HARDWOOD	4	-	NO
8	DROPBOARDS	HARDWOOD	20	-	NO
9	FIBREGLASS PANEL MOULD		2	-	NO
10	FIBREGLASS CHUTE MOULD	SEE SPECIFICATIONS	1	-	NO
11	DENIL PANELS	FIBREGLASS SEE SPECIFICATIONS	100	-	NO
12	DENIL CHUTE NO 5 UNIT		1	-	NO.
13	DENIL CHUTE NO 4 UNIT		1	-	NO.
14	DENIL CHUTE NO 3 UNIT		1	-	NO.
15	DENIL CHUTE NO 2 UNIT		1	-	NO.
16	DENIL CHUTE NO 1 UNIT		1	-	NO.
17	300 x 1200 x 10 SHEET		2	-	NO.
18	20mm GRAVEL	SEE SPECIFICATIONS	-	18.5	m^3
19	REINFORCED CONCRETE	SEE SPECIFICATIONS	-	4.6	m^3
20	CONCRETE EXCAVATION		-	4.0	m^3



PLAN
SCALE 1:50
(GRATE NOT SHOWN)



SECTION 10
1:50

NOTES

1. FOR GENERAL NOTES REFER TO DRAWING No 31260-001

SCALE 1: 1000 (on A1 Sheet)
SCALE 1: 50 (on A1 Sheet)

ISSUE	DATE	AMENDMENT / ISSUE DESCRIPTION	APPROVAL
A	15.03.02	ISSUED FOR CONSTRUCTION	
B	21.03.02	NOTES AND ARROWS ADDED	

TITLE	INITIAL	SIGNATURE	DATE
DRAFTSMAN	A.B.	A.BARTON	15.03.02
DRAFTING CHECK	M.H.	M.HATTON	15.03.02
DESIGNER	D.A.	D.ATKIN	15.03.02
DESIGN CHECK	K.S.	K.SMIT	15.03.02
PROJECT MANAGER	K.S.	K.SMIT	15.03.02

CLIENT
APPROVED DATE

SMEC
SMEC AUSTRALIA PTY LTD
© ACN 065 475 149
LEVEL 5 118 WALKER STREET NORTH SYDNEY NSW. 2060
PH 02 9925-5555 FAX 02 9925-5566

PROJECT TITLE
EUSTON WEIR
PROPOSED DENIL FISHWAY
GENERAL ARRANGEMENT

SCALE	DRAWING STATUS	PROJECT / DRAWING No.	ISSUE
AS SHOWN	PRELIMINARY	31260-002	B

153 mm ON ORIGINAL

Top/bottom comparisons

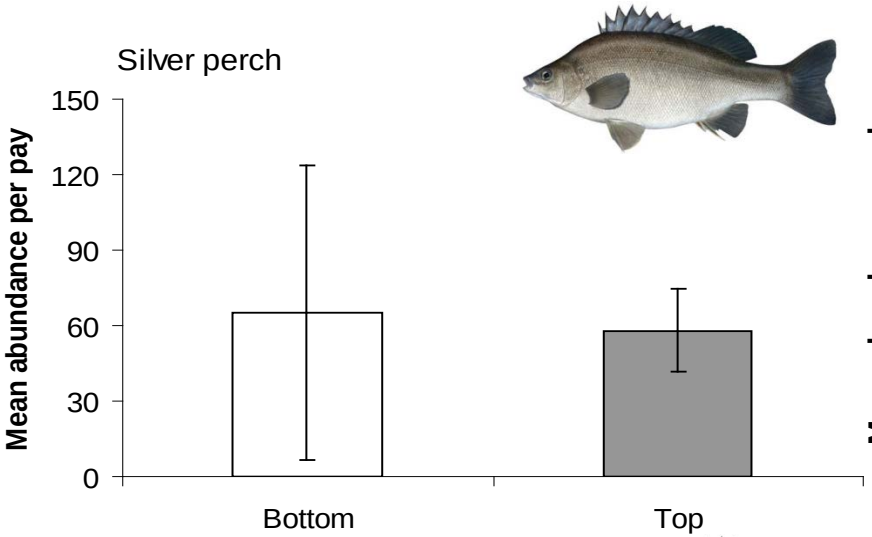
Trapped the top and bottom of the fishway for over 40 days between Sept 2004 and Nov 2005

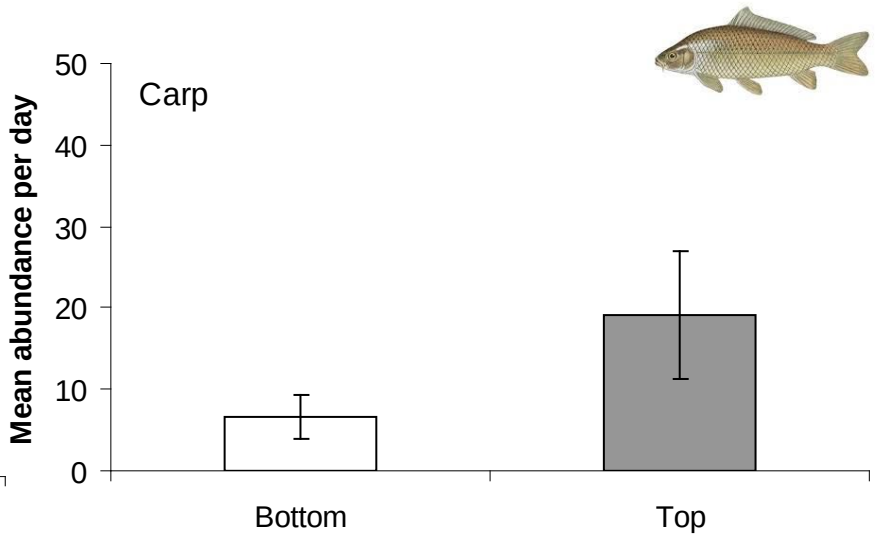
Performed 24 hr trap sets

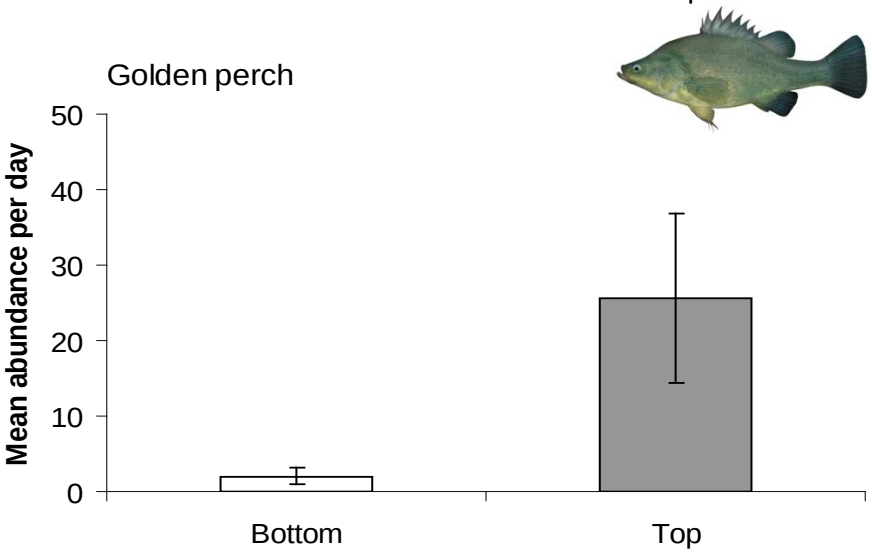
6mm mesh on traps

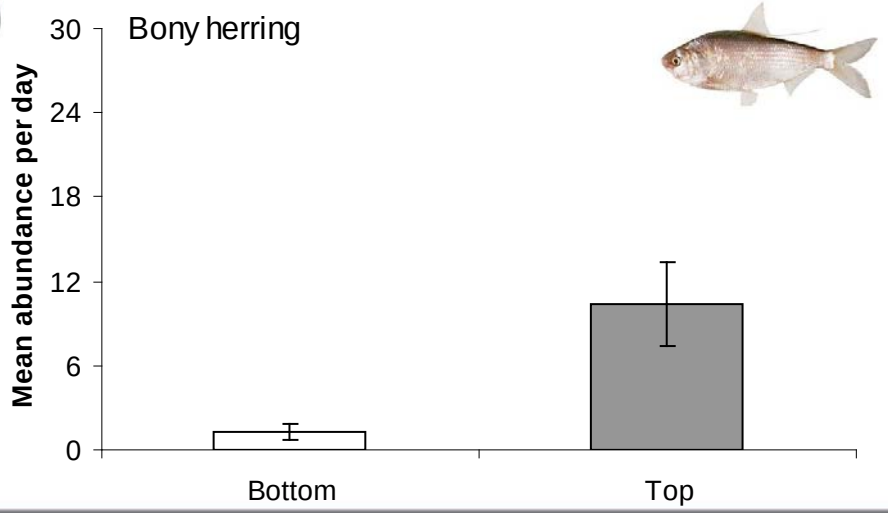
Trapped a range of flows

Relative Abundances (large-bodied species)



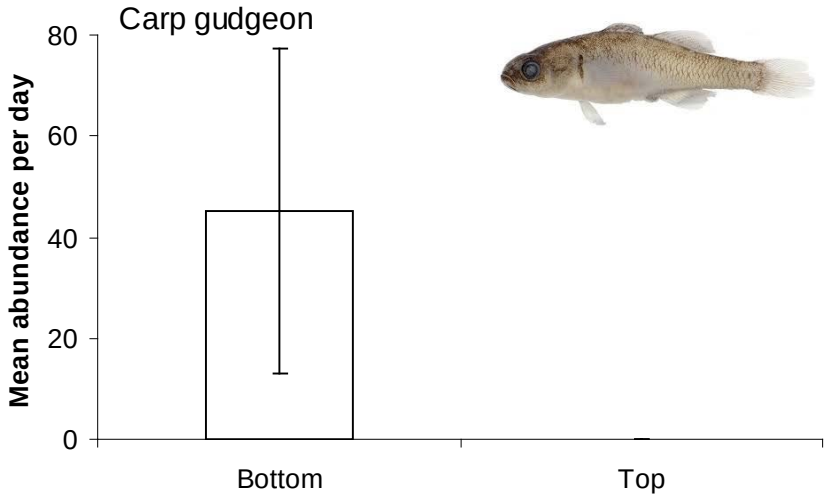


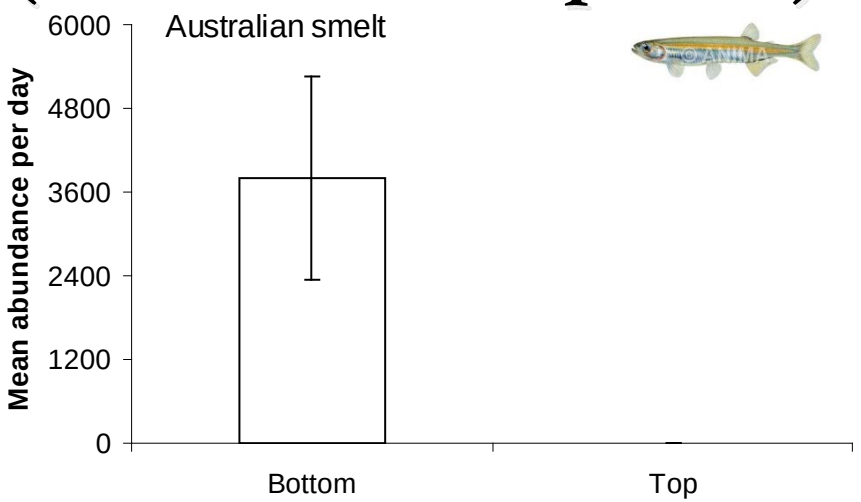


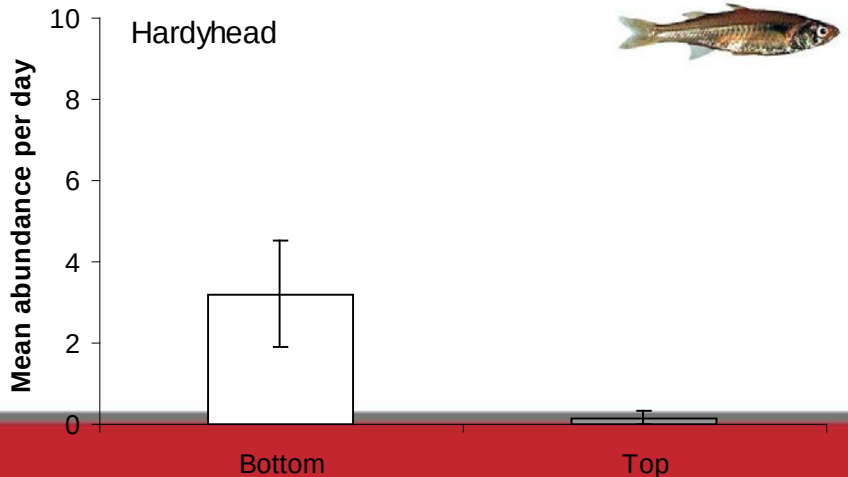


Top/bottom comparisons

Relative Abundances (small-bodied species)



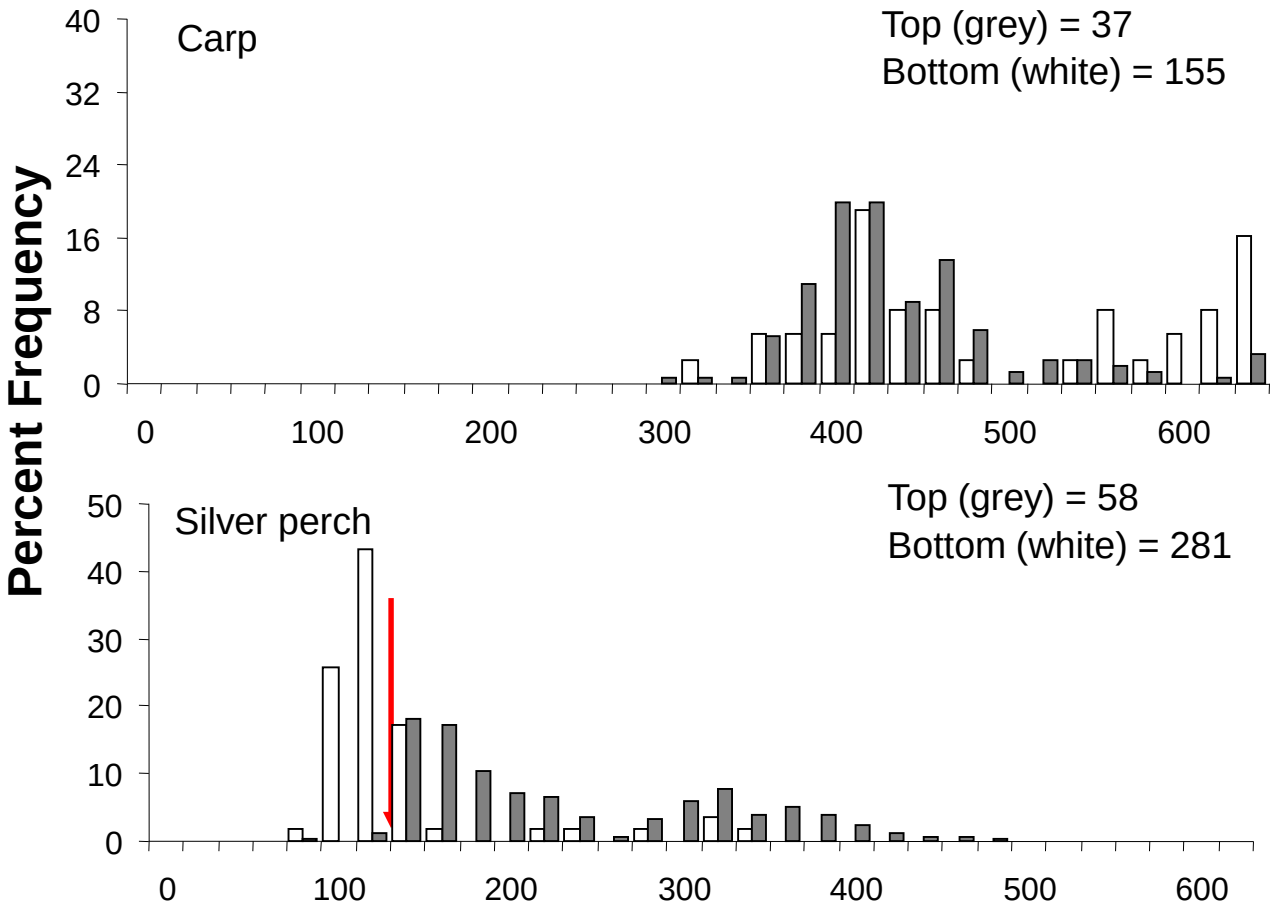




No passage for small-bodied species

Only, one hardyhead reached the exit

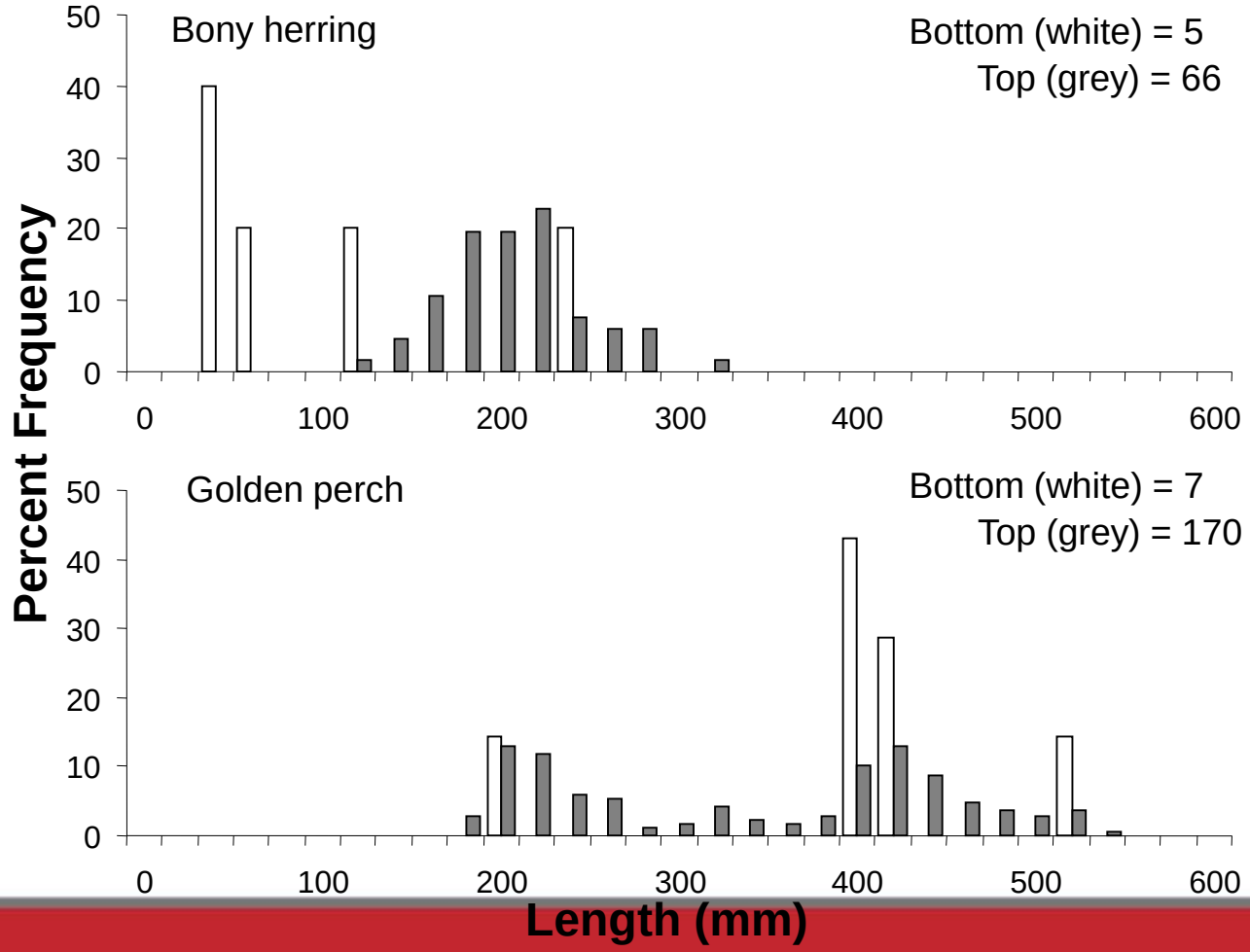
Top/bottom comparisons



Few silvers smaller than 140mm ascending but were found at bottom

Top/bottom comparisons

Length-Frequency Data



Bony herring able to ascend but none smaller than 120mm

Golden perch reached the top, but mostly large fish

Top/bottom Results summary

Passage good for individuals >200mm

Passage limited for individuals <200mm

No passage for small-bodied species

D/B Ratio work

Charles Sturt University

Assessed fishway under 3 different D/B ratios

D/B 0.5 = Depth 15cm

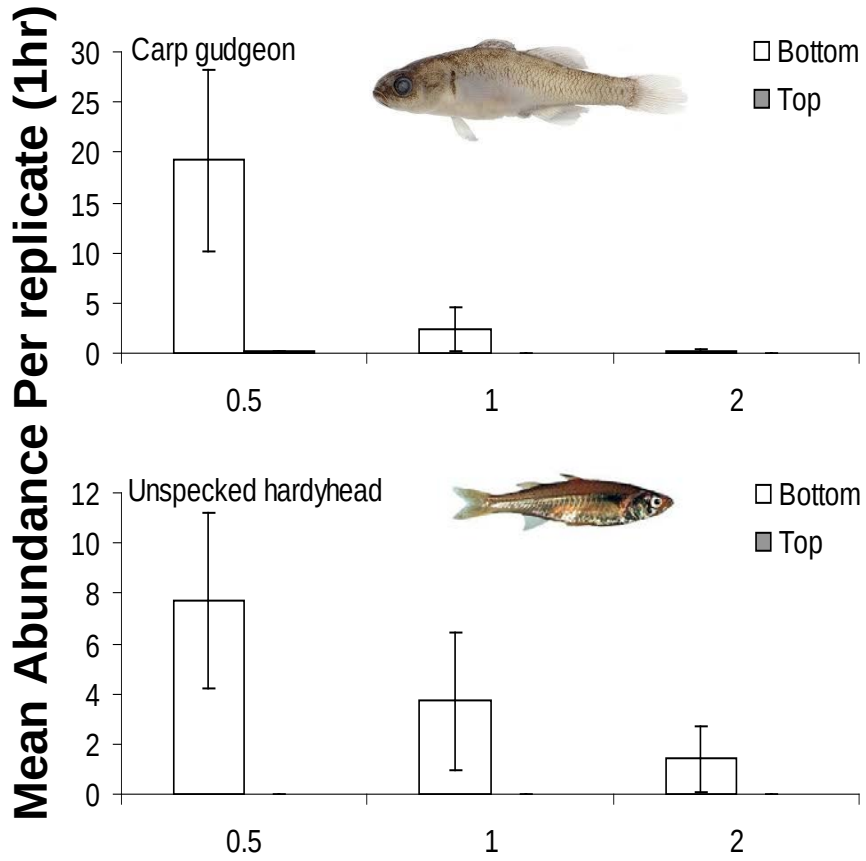
D/B 1.0 = Depth 30cm

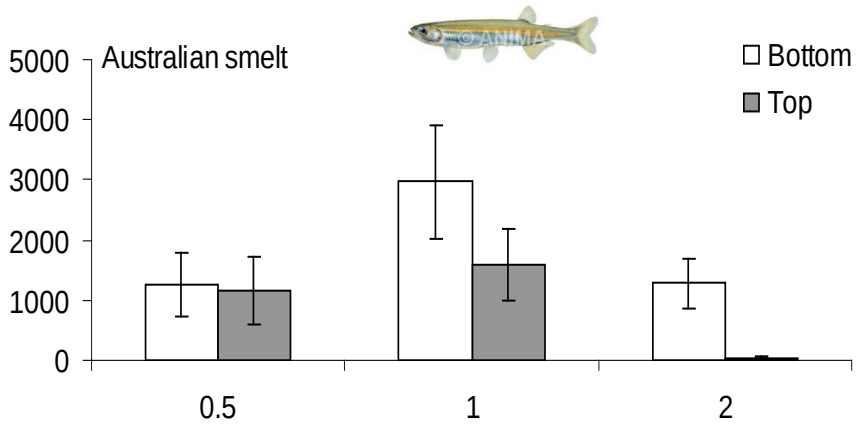
D/B 2.0 = Depth 60cm

NB: A D/B of 2.0 was close to 'normal' operating conditions

D/B Ratio work

Abundance (Small-bodied species)



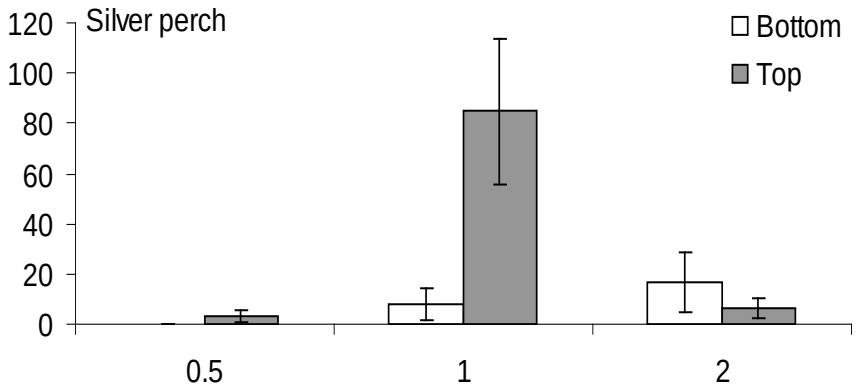


No passage of carp gudgeon or hardyhead under any configuration

Limited passage of smelt at d/b > 1.0

D/B Ratio work

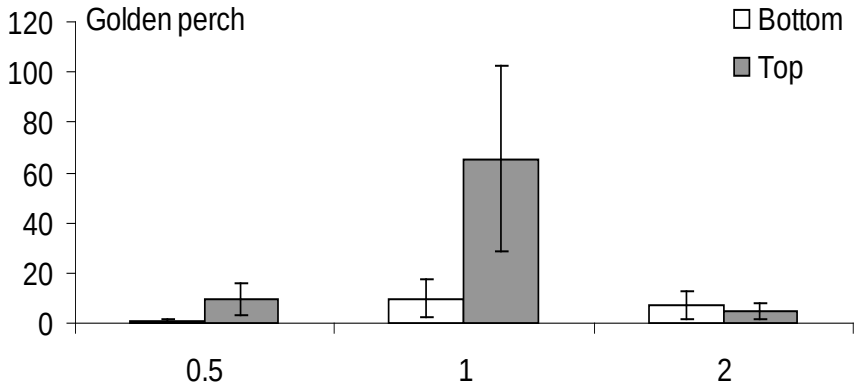
Abundance (large-bodied species)

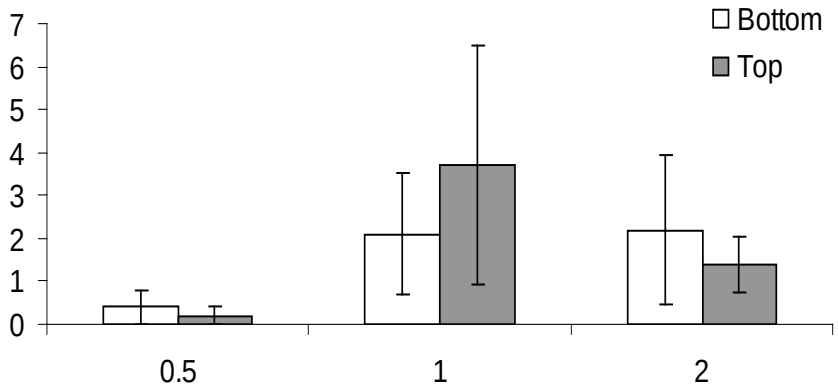


Limited passage at d/b = 2.0

Limited passage at d/b = 0.5 (maybe a function of reduced attraction flow and/or depth?)

Good passage at d/b = 1.0





Mean Abundance Per replicate (1hr)

D/B Ratio

D/B Ratio Summary

So how to best provide for small fish?

D/B **nd greater**

D/B = 1 ok for mediu **80mm and also smelt > 35mm**

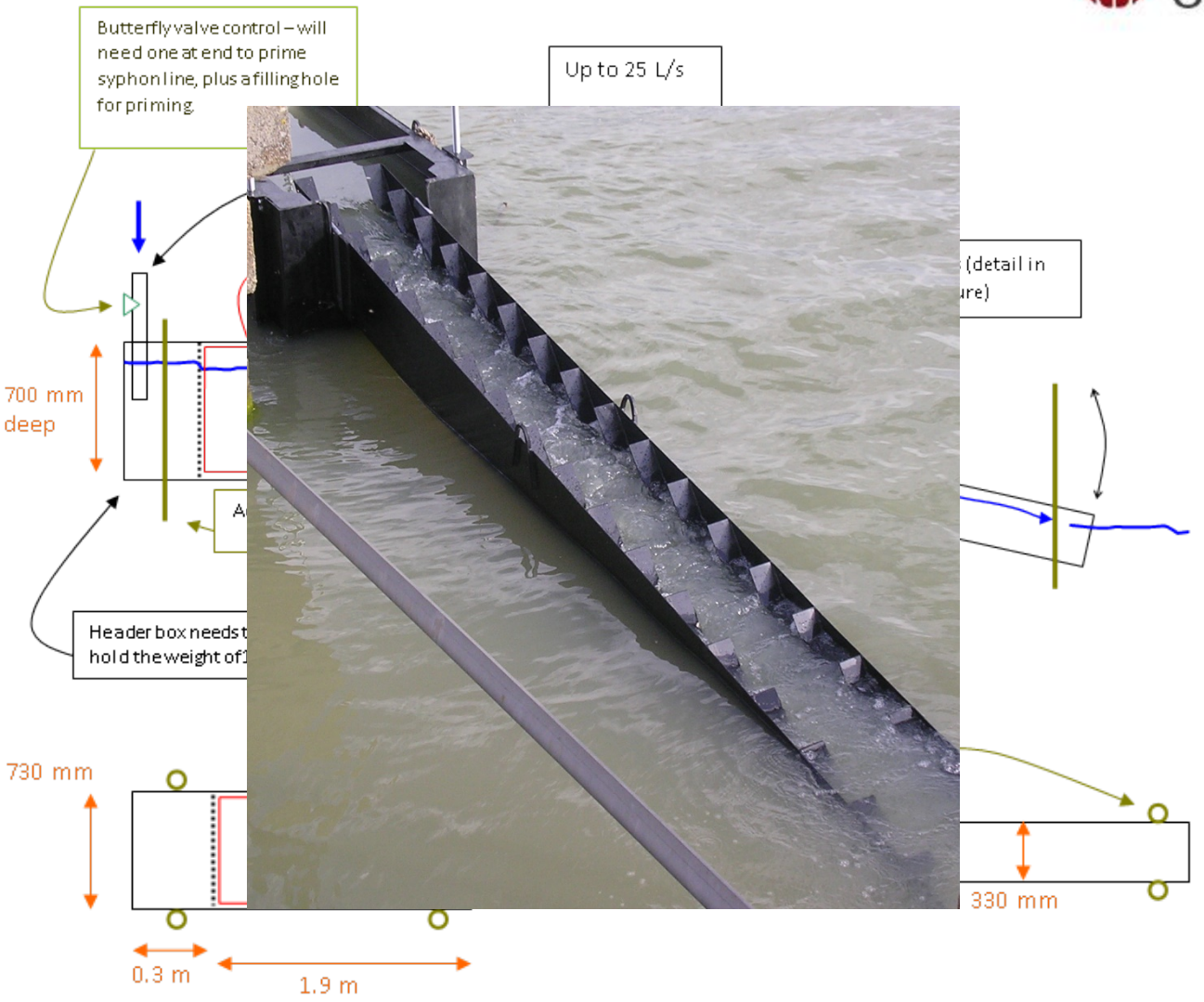
D/B = 0.5 increased passage of smelt but **(depth/attraction issues?). Carp gudgeons or** **uld not ascend**

Lock 8 Weir and VS fishway

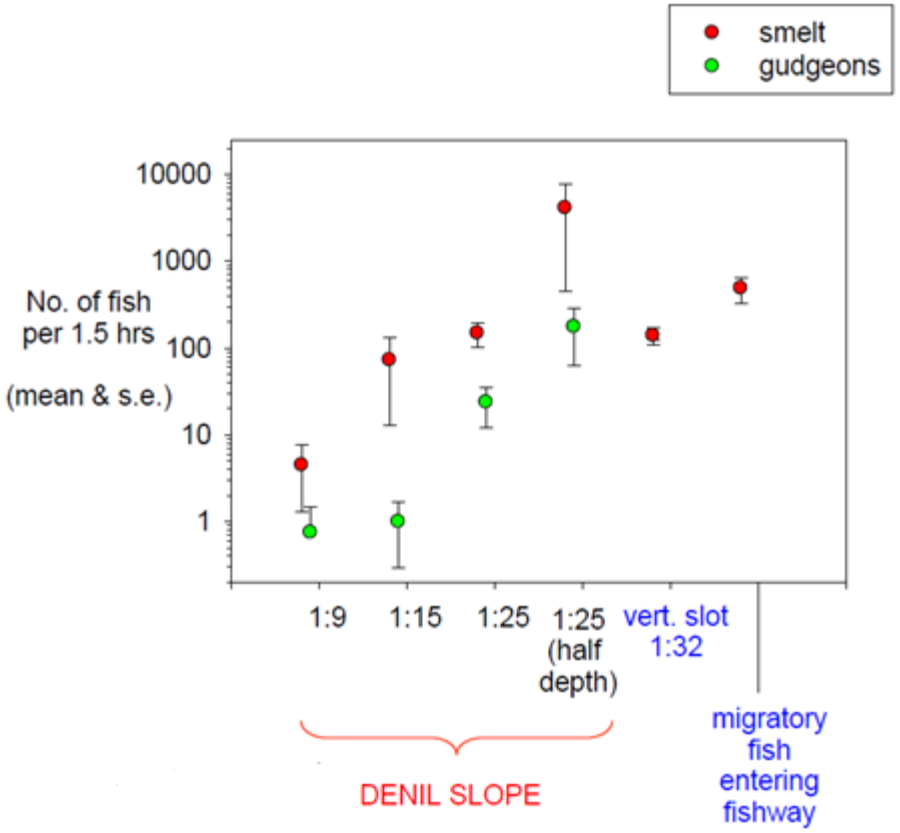
Example: Experimental fishway - Denil

Side view

Plan view



Tested different slopes



Conclusions

The Denil design was good for bigger fish but does not enable the goal of fish community passage.

Denil fishways are really limited to temporary application at sites for high tailwater

or

During construction of a permanent fishway where d/b is satisfied

Acknowledgements

Sets of hands:
- Fisheries NSW (Nathan Reynoldson, Jonathon Doyle, Craig Boys),
- Euston fishway (Ray McMaster, Phil Cocks)
- Charles Sturt University (Jarrod McPherson)
- Lock 8 fishway (John McNeil, Colin Fitzpatrick)
- Arthur Rylan Institute (Matt Jones)
- SARDI Aquatic Sciences (Kathleen Beyer)

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Murray-Darling Basin Authority; Australian Centre for International Agricultural Research

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